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The Role of Computer Simulation in the Context of Zero-emission Power Plants

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SLIDE PRESENTATION

The Role of Computer Simulation in the Context of Zero-emission Power Plants

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Jan. 24th, 1997

**WORKSHOP:
ZERO-EMISSION POWER CYCLES**

**Organized by
Ph. MATHIEU and E. IANTOVSKI**

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The role of computer simulation in the context of zero-emission power plants

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Simulation

- Computer simulation is an ideal methodology for the development of potential zero-emission power plants
- There has been a dramatic reduction in the cost of producing highly accurate power plant simulators
- There is good experience with the validation of power plant simulators

Goal and Strategy

- The goal is to make available a range of technically, economically and environmentally viable zero-emission power plants
- This goal must be achieved at minimum risk and cost and in a way that will attract investment from funding bodies and industry

Obstacles to realization

- Power plant technical uncertainties relating to the cycle, components and operating procedures
- Uncertainties relating to CO₂ disposal where carbon-containing fuels are oxidized

Simulation has a role in overcoming both obstacles

Today's Situation

- Quite a few potential zero-emission power plants have already been proposed. Many other schemes and variants are possible
- The power industry is very conservative
- Design improvements tend to be incremental
- Radical departures from existing practice are prohibitively expensive

How Did We Get Here?

- The transition from steam-only power plants to high efficiency combined cycle plants has been a slow and progressive one
- This evolution might have been even slower if it had not been for the availability of highly developed aero gas turbine engines
- Future developments need to be on more radical lines and should not be over-constrained by present technology

Two Available Options

- Commit vast resources to designing and constructing a small number of prototype zero-emission power plants and evaluate these
- Commit significant resources, but far less than for the first option, to computer simulation. Simulate many plants in outline. Select a small number and simulate these in great detail.

Recommendation

- Highly accurate computer simulation models are proposed for the development of zero-emission power plants
- These plant simulators should be independently tested and evaluated
- By building and fully testing virtual zero-emission plants first, the cost of implementing the real plants can be kept to a minimum

Possible Plant Simulation Model

- Real time dynamic simulation of all plant components, validated by specialists in each technological area
- Component models and overall solution algorithm in FORTRAN 90
- Front end programmed in Visual Basic or C++
- Model can run on networked Pentium PCs running under Windows NT or Windows '95

CO₂ Disposal Options

- Appropriate simulation models for the long term storage of CO₂ can be developed
- Here too, it is suggested, development costs can be minimised by placing considerable reliance on highly detailed simulation models
- Models to be validated by a range of specialists

Summary

- There is a need for a strong consortium of research groups and industrial companies to work together to simulate zero-emission power plants in the fine detail
- This should give rise to a range of viable zero-emission power plant designs

ATERG

The Applied Thermodynamics and Energy Research Group (ATERG) was founded in 1989 and is directed by Dr. Jim McGovern



Also

It is proposed to establish a new campus company in 1997 to provide computer based technical simulation of energy transforming plants ...

